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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in Prosthetic Supports

We, HELMUT KÖHLER and HERMANN MAY, both citizens of Austria, Trading as "VIENNATONE HÖRGERÄTE" ING KOHLER UND ING MAY OFFENE HANDELS GESELLSCHAFT respectively of, Schönbrunnergraben 92, Vienna 18, Austria and Geusaugasse 12/10, Qiwn 3, Austria, do hereby declare the invention for which we pray that a Patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to prosthetic supports.

It has already been proposed to us the myoelectrical potentials which are generated when a muscle contracts for the purpose of controlling the motion of prostheses. For this purpose two relatively spaced receptor electrodes are applied to the skin at locations above and lengthwise of the group of muscles which would normally generate the desired motion, or above the stump left by amputation, these electrodes transmitting the potentials that appear during the voluntary contraction of the muscle through electrical leads to a control circuit which amplifies these potentials, converts them and applies them to the switch means of electrometer or pneumatic devices for effecting movements of parts of an artificial limb.

For instance, in the case of a forearm prosthesis which reproduces the gripping movements of the hand, two receptor electrodes are applied to the skin lengthwise of the remaining muscle fibres of the flexor in the upper arm, which controls the closing of the hand, and two electrodes are applied lengthwise of the extensor, which controls the opening of the hand. The potentials which appear when the flexor or extensor is contracted are picked off by the associated pair of electrodes and transmitted to separate control channels in the amplifier circuit. A relay is then operated to cause voltage to be applied to the actuating motor of the prosthesis with the polarity for generating the required hand of rotation, the rotation of the motor being then converted through a gearing into the required movement of the artificial hand.

If it should be impossible to derive controlling potentials from the flexor and/or extensor, then such a potential may be derived from some other muscle or residual muscle in which case the wearer of the prosthesis is capable of accustoming himself to this change. For example, the potentials could be derived from that pair of muscles which otherwise controls the retraction and extension of the hand on the wrist and these potentials could be used for controlling the gripping mechanism. In principle any other muscle of the body that is still intact could be so used as a controlling potential source. The wearer of the prosthesis quickly learns how to control gripping movements of the hand by the voluntary contraction of muscles which originally served other purposes.

It must be borne in mind that whenever the prosthesis is removed it must be detached from the leads which connect it to the control unit which may be worn on some other part of the body. Since a prosthesis is usually taken off once a day the electrodes must be so contrived that their repeated removal and replacement do not affect their safe connection to the artificial limb. The electrodes should bear closely with slight pressure on the skin, but any painful local pressure must be avoided.

The present invention consists in a prosthetic support having electrodes for detecting myoelectric voltages for controlling the

movements of an artificial limb comprising a supporting member adapted to be attached to the body of a user and formed with two openings respectively disposed at locations where, in use of the support, myoelectric voltages are generated during muscular contraction of the user, electrodes slidably received within the openings, and an electrode holder which is releasably secured to the supporting member at a location intermediate the openings, engages the electrodes and, by virtue of its inherent resilience, in use of the support serves to maintain the electrodes in contact with the body of the user.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a section of an arrangement according to the invention; Figure 2 is a plan view of the arrangement of Figure 1; and

Figure 3 is a section of a second arrangement according to the invention.

In the drawings, a portion of a supporting member 2 of a prosthesis is adapted to a part 1 of the body of a wearer. The supporting member 2 may take the form of a conventional socket individually fashioned to fit the wearer and made of an insulating material, this socket being provided with supporting straps, buckles and so forth. Openings 3 in the supporting member 2 are so located that they will come to lie exactly above the locations of optimum potential take-off, which locations have been determined by measurement before the supporting member 2 is adapted to the wearer's needs. For generating the closing action of the hand the openings 3 in the supporting member 2 are located above the flexor, lengthwise thereof. The openings 3 are bores drilled directly into the supporting member 2 and the adhesive insertion of a wear resistant bushing into an overdimensioned hole may also be an advisable and easily performed step.

In the embodiment shown in Figure 1, receptor electrodes 4 are detachably secured to a hoop 5 made of a synthetic material of the thermoplastic kind. Each electrode is formed with a hole 12 and a lead 6 extends through this hole and is attached to the electrode by means of a screw 13. The leads 6 are combined in a common cable 9 which is connected to an electronic control unit.

Anchored in the supporting member 2, between the openings 3, is a male member 7 of a press stud, the associated socket 8 being inserted in the hoop 5 in an appropriate position between the two receptor electrodes 4. Naturally the positions of the male and female members of the press stud may be reversed.

When the artificial limb has been adapted to the stump and the openings 3 have been provided in the predetermined positions, the hoop 5 is briefly heated with hot air for the purpose of adapting the curvature thereof to the local curvature of the sleeve-like member 2. The receptor electrodes 4 are then inserted into respective openings 3 whilst the hoop 5 is still plastic and gently pressed onto the skin. Finally, the hoop 5 is secured to the supporting member 2 of the prosthesis by closing the press stud 7, 8. Owing to the brief heating of the hoop 5 its shape can be adapted to that of the supporting member 2 and at the same time a contact pressure of any desired magnitude can be established.

In the embodiment shown in Figure 3, receptor electrodes 4 are independently inserted into respective openings 3 in a supporting member 2 and the hoop 5 of Figures 1 and 2 is replaced by a press stud device 10, which is formed with lateral extensions 11. These extensions 11 resemble leaf springs made of an insulating material and are so arranged that their ends apply pressure to the electrodes 4 in the openings 3 of the supporting member 2 to provide the required contact between electrodes and skin. For connection to the leads 6 each receptor electrode 4 is pierced by an oblique channel 12 into which the ends of the leads can be inserted and clamped by a screw 13.

The above arrangements of the receptor electrodes 4 in openings 3 in the supporting member 2 and their location by means of a press stud 7, 8 or 10 affords considerable advantages. More particularly, the arrangements permit the required contact pressure of the electrodes to be easily adjusted and also to be quickly re-adjusted at any time to relieve painful pressure points. The proposed arrangements are so devised that they can be easily assembled and undone with one hand. This is a special advantage when several electrodes are provided on the supporting member of the artificial limb for simultaneously controlling the gripping action of the hand as well as rotary movements of the wrist and up and down movements of the forearm.

The actual movement of the artificial limb is conveniently generated by battery-powered miniature motors (not shown) which need not necessarily be of the rotary type. Operation by pneumatic or hydraulic actuating cylinders may also be contemplated.

For fixing the male member 7 of the press stud 7, 8 of Figures 1 and 2 or 10 of Figure 3 a centring hole 14 is formed in supporting member 2 at the same time as the holes 3 for the reception of the electrodes. The male member of the stud is firmly fitted to a deformable platelet 15

which has a centring pin 16. The platelet 15 is adhesively affixed to the supporting member 2 of the prosthesis.

WHAT WE CLAIM IS:—

1. A prosthetic support having electrodes for detecting myoelectric voltages for controlling the movements of an artificial limb comprising a supporting member adapted to be attached to the body of a user and formed with two openings respectively disposed at locations where, in use of the support, myoelectric voltages are generated during muscular contraction of the user, electrodes slidably received within the openings, and an electrode holder which is releasably secured to the supporting member at a location intermediate the openings, engages the electrodes and, by virtue of its inherent resilience, in use of the support serves to maintain the electrodes in contact with the body of the user.

2. A prosthetic support as claimed in claim 1, wherein the supporting member is formed with a centring hole at a location intermediate the said openings, a fixing member is secured to the supporting member by engagement of a pin thereof in the centring hole, and the electrode holder includes a fixing member co-operable with the fixing member on the supporting member to releasably secure the holder to the supporting member.

3. A prosthetic support as claimed in claim 1 or 2, wherein the electrode holder is releasably secured to the supporting member by means of a press stud device.

4. A prosthetic support as claimed in claim 1, 2 or 3, wherein the electrode holder comprises outer parts formed of thermoplastics material upon which respective electrodes are mounted.

5. A prosthetic support as claimed in claim 1, 2 or 3, wherein the electrode holder comprises outer parts in the form of leaf springs which are made of electrically insulating material and which bear upon respective electrodes.

6. A prosthetic support constructed, arranged and adapted to operate substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.

MATHYS & SQUIRE,
Chartered Patent Agents,
10 Fleet Street,
London, E.C.4.
Agents for the Applicants.

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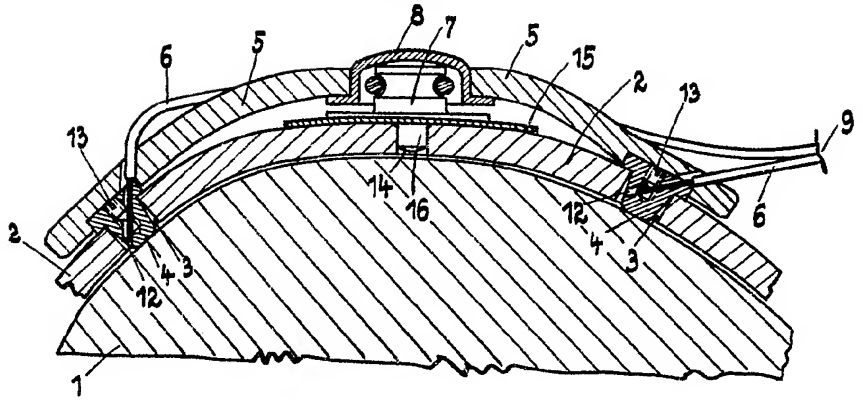
This drawing is a reproduction of the Original on a reduced scale.

Fig.1



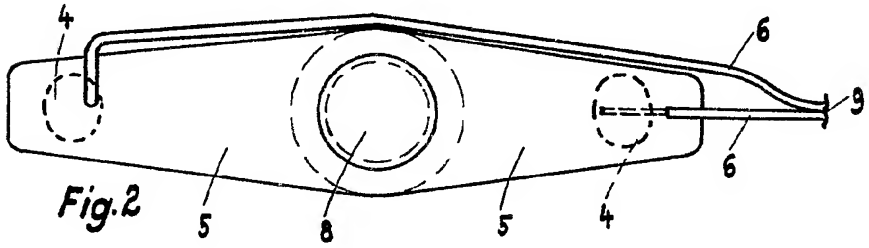


Fig.2

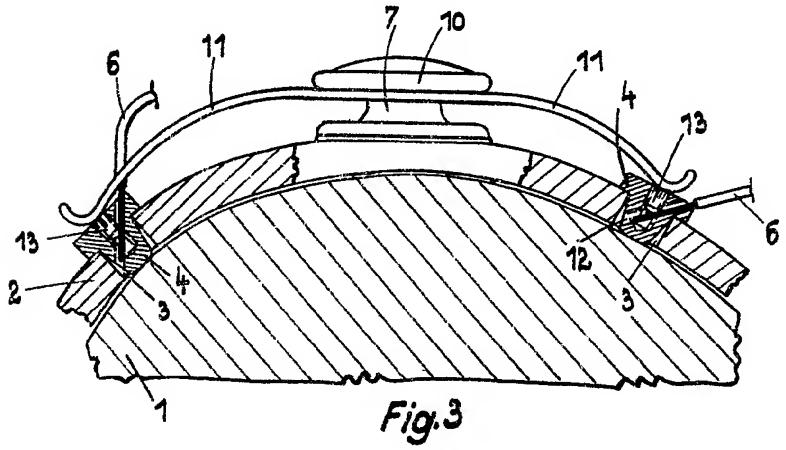


Fig.3